Visualization, Semantics, and Aesthetics

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This panel brings together artists, designers, computer scientists, and language theorists whose work integrates different forms of linguistics, such as computational and mathematics, with designing both computational systems and art works.

Visualization represents processes as much as objects, which is contiguous with much of contemporary art. Art and computer code share a basic intent: expression. There is an intense pleasure in putting the unknown and the unknowable into language. And there is tension between computer code and design: code requires precision; art requires abstraction and manipulation.

As images, visualizations are powerful and often beautiful in their own right. Why do some evoke erotic delight, and others a sense of awe? If visualization makes data meaningful to humans, what role does aesthetics play in this process? Where do the aesthetics of visualization act back on current design and art making? Is there a relationship between information: pattern: meaning? Simulations are intended to look like an actual process or natural form. What happens when we abstract simulations and apply them to other semantic systems? If the process behind the visualization itself supplies the "real," then computer science and art share the need to work with structuralist languages, abstraction, and an aesthetics capable of feeling process, rather than representation.

As researchers in the fields of visualization, computational linguistics, simulation, aesthetics, visual arts, and sociology work together, what new forms of language, meaning, and interpretation arise from these collaborations? What language can we use to describe our practice? Topography and topology are two valuable words. Can patterns be recognized in emotional or meaningful ways? What is the gap between recognition and meaning? Can these collaborations bring us beyond aesthetics of space or narrative? In what ways? How can this new knowledge be applied to large-scale systems, such as the Internet, forestry, and astronomy? Can aesthetics make data meaningful to larger publics or user groups?

Sheelagh Carpendale

In our information-dominated society, the favoured modes of information presentation are shifting away from a primarily verbal emphasis toward incorporation of a variety of visual forms. Rapidly increasing amounts of our communications are visual, and this trend has been accelerating in recent years. A great many advantages have been attributed to the ability to create good visual representations. Card et al. have declared that we should consider the possibility that information visualization can aid thinking processes.[1]

Can we then create visualizations that enhance cognitive abilities? In response to this challenge, there is a growing body of visualization research that strives to create intuitive visualizations through, on the scientific side, incorporation of perceptual and cognitive principles and, on the artistic side, recognition of the importance of emphasis, distinctions, and impact. However, there is another side to this issue: no matter how intuitive these visualizations are, they have to be interpreted by a person.

As a society, we place a great deal of emphasis on educating our children to become verbally literate. With the growing trend toward visual communication, a better understanding of visualization and visual presentation in general is becoming essential. However, to a great extent our education system still ignores this trend. While our children spend approximately 12 years of their lives learning to become verbally literate, comparatively little time is devoted to developing visual literacy.

Sheelagh Carpendale joined the Department of Computer Science at the University of Calgary in October 1999 and is a recipient of the National Science and Engineering Research Council University Faculty Award. Her research focuses on information visualization, where she makes a distinction between creation of visual representations and their presentation. In presentation space, she is exploring the resilient elastic properties available in virtual presentation. In representation space, she is investigating the possibilities of increasing or at least varying the methods that provide people, rather than algorithms, expressive control for creation and manipulation of representations.

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Victoria Interrante

Visualization research is concerned with design and implementation of methods for effectively communicating information through images. The crucial initial step in this effort is conceptualization of the representational methodology: how do we intend to portray a set of data so as to allow the critical information that it contains to be easily, accurately, and intuitively understood? The solution to this problem requires not only a thorough understanding of the needs of the application, in order to choose wisely what aspects or features of the data to show, but also a keen understanding of the processes of visual perception, combined with a healthy dose of creative inspiration, in order to choose wisely how to show it.

A fundamental philosophy that underlies much of my work in visualization design is that there is a science behind the art of effective visual communication that can provide objective reasons why certain pictorial representations of data can be expected to be more effective than others and theoretical guidance for knowing how to create images in which the most important aspects of the information can be most easily and accurately perceived. Although our understanding of the scientific principles that underlie the design of an effective visual representation is still in its infancy, and creating a visualization that works remains largely an art, one of my goals is to make explicit aspects of the intuition that a good designer accumulates from experience and training, and relies upon when translating ideas to images.

Victoria Interrante is a McKnight Land-Grant Professor in the Department of Computer Science and Engineering at the University of Minnesota and a recipient of the fiscal year 2000 Presidential Early Career Award for Scientists and Engineers. She received her PhD in 1996 from the University of North Carolina at Chapel Hill, where she studied under the joint direction of Henry Fuchs and Stephen Pizer. From 1996 to 1998, she worked as a staff scientist at ICASE, a non-profit research center operated by the Universities Space Research Association at NASA Langley. Her research focuses on application of insights from perceptual psychophysics, art, and illustration to design of more effective techniques for visualizing data.

Jason Lewis
First the Dadaists and then the Concrete Poets surfaced the semantics implicit in the aesthetics of written language. Typefaces are not neutral; layout is not simply rational or irrational. Throw text on-screen, give it the ability to move and interact with a user, and the active meaning-making inherent in the visible construction of letterforms becomes impossible to ignore. Now apply that to attempts to visualize large-scale conversations and one quickly finds that the creative and intellectual possibilities are not only infinitely fascinating, but also (potentially) dangerous over-active participants alongside the users themselves.

Jason Lewis brings 10 years' experience in a wide variety of research environments to bear on the question of how to enrich and extend the user's experience of digital media. He is a practicing artist, designer, and technology developer, and recently founded the Arts AllIance Laboratory in San Francisco. His work has appeared at Ars Electronica, ISEA, and the annual SIGGRAPH conference, and he currently has a piece, TextOrgan, on two-year display at the Ars Electronica Center. He has spoken at the Banff Centre for the Arts, the San Francisco Museum of Modern Art , and the UCLA Department of Design, and worked at Interval Research Corporation, the Institute for Research on Learning, Fitch, and USWest Advanced Technologies. He holds a BS and BA degree from Stanford University, and a MPhil from the Royal College of Art, London.

Joshua Portway
The RealWorld exhibition will take the form of a darkened room with a domed ceiling upon which a computer display will be projected, like a planetarium. Audiences will be immersed in a world of real-time stock market activity, represented as the night sky, full of stars that glow as trading takes place on particular stocks.

Like the complex visualisation systems used by investors and traders to analyse the market, the system abstracts the information to help us read patterns in the data. Each layer of abstraction distances us further from the actual people that the data represents, until our system comes full circle and a new layer of living creatures emerges within the data itself.

The project links the earliest theories, such as astrology, to the latest scientific visualization systems. It examines the urge to understand our environment; the desire to predict, recognize patterns, and impose structure; and the limits of this ambition. By exploring our desire to abstract and order our environment, the project will act as a focus for debate about how much control is possible over complex systems such as the natural environment or the economy. The project explores an important issue for the 21st century: systems that we have created, such as the economy, the latest computer systems, genetically modified organisms, or even ideas, can generate their own behaviour and eventually transcend their origins, and may already be more powerful than we can control.

Joshua Portway's first video game was published 17 years ago and became a best-seller in Britain. Since then he has produced work as an artist, games designer, and animator. His interactive installation work has been exhibited in the UK, the US, and Denmark, and his animation work (including videos for Peter Gabriel, MTV, and others) has been shown at festivals and on television worldwide. In 1991 he formed Flux Digital, an interactive media and broadcast animation production company, which he left to join RealWorld in 1995. At RealWorld he has been trying to map the strange territories between music and interactive media, and is currently developing some secret and wonderful interactive music technology, to be released "soon." His latest project, Black Shoals, was exhibited at the Tate Gallery, London, in 2001.

David Sless
I'm interested in the philosophy of communication: the nature of communication and how we think about it. Approaches to visualisation and aesthetics make assumptions about the nature of communication. Some of these assumptions are built into the programming languages we use. Programming languages have semantic and syntactic properties. The notions of semantics and syntactics derive from communication theory.

I suggest that as these notions are currently applied, they are deeply flawed and impose an unnecessary limitation on programming and other intellectual pursuits. Alongside semantics and syntactics, there is a third category: pragmatics. I have come to the view that syntactics and semantics are subcategories within pragmatics rather than categories in their own right. The implications of this view are far-reaching and may change the way we develop future programming languages. In this panel, I use some of our recent research to illustrate the types of visual aesthetic problems that lie beyond contemporary computing languages but which may be possible if we rethink how such languages are constructed.

David Sless is director of the Communication Research Institute of Australia. He graduated from Leeds University in 1965 with an honours degree in psychology and sociology. Fascinated by communication problems in ordinary life (such things as signage systems that confuse people and labels that people can't understand), he went on to do research into ways of improving communication. In 1975, he was awarded an MSc by Durham University for his research in this field. He was then invited to take up a lectureship at Flinders University in South Australia to continue his research and teaching in communication. The relevance of his research into practical everyday problems of communication has now been widely recognised.

Sha Xin-Wei
If the power of making a trace comes from fashioning matter in the space of the imaginary, then mathematical drawing, sketching, and tracing have peculiar power. How is it that with a few strokes we create and shape geometries of arbitrary dimension or entities that have infinite extent? The creative power of visualization comes from somewhere in between the topological and the geometric.

What is the geometric? Riemannian geometry, for example, offers enough metric and curvature structure to sustain a kinematic intuition with functional, even computable presentation. But topology sustains ways to work both rigorously and intuitively about notions such as continuity, openness, convergence, and connectedness without binding us to any Cartesian framework. Imagining visualization as a process rather than a static representation, focusing on spaces of mappings rather than particular geometric domains, may bring us to the cusp of meaningful gesture and show us a way into the creation of felt meaning.

Sha Xin-Wei was trained in mathematics at Harvard and Stanford Universities, then worked in the fields of scientific computation, mathematical modeling, and visualization of scientific data and geometric structures. Since 1995, he has extended his work to distributed media authoring systems and media theory, in a three-year workshop on interaction and computational media.

After obtaining an interdisciplinary PhD at Stanford on differential geometric performance and the technologies of writing (in mathematics, computer science, and the history and philosophy of science), he joined the faculty of the School of Literature, Communication, and Culture at the Georgia Institute of Technology. He is currently constructing fusion experiments that materialize as cultural artifacts with colleagues in the TGarden Consortium and the Hubbub urban speech-painting project.

Sara Diamond
Sara Diamond is artistic director of media and visual art at The Banff Centre for the Arts. She leads all research, residency, exhibition, and training in the field of new media, television, and visual art at this international artistic research and professional development centre. She is also adjunct professor in the Design Media Department at the University of California, Los Angeles. She is currently writer in residence at the University of Surrey.

Her research explores the relationships among performance, role playing, dialogues, and the capacity of technologies, in particular visualization technologies, to provide tools, meanings, and emotional experiences for users. Her own research, Code Zebra, is a multiyear project with collaborators in Brazil, the USA, Canada, the United Kingdom, and Australia, exploring dialogues between artists and scientists using live and virtual tools. She has published extensively and curated exhibitions around the world. She develops new media streams for The Banff Television Festival and other world-renowned events.

Reference
1. Card, S. K., Mackinlay, J. D., & Shneiderman B. (1999). Information visualization: Using vision to think. Morgan Kaufmann, 1999.

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